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Reynolds

[11] Patent Number: **5,774,825**[45] Date of Patent: **Jun. 30, 1998**[54] **SYSTEM FOR AUTOMATIC VEHICLE LOCATION VIA CABLE TV**[75] Inventor: **James C. Reynolds**, San Jose, Calif.[73] Assignee: **Trimble Navigation Limited**, Sunnyvale, Calif.[21] Appl. No.: **544,556**[22] Filed: **Oct. 18, 1995**[51] Int. Cl.⁶ **G08G 1/123**; G01S 3/02[52] U.S. Cl. **701/207**; 701/213; 701/219; 340/989; 348/7

[58] Field of Search 364/449.7; 340/989, 340/993, 990; 348/7, 8, 6; 342/357, 457; 701/213, 207, 219, 300

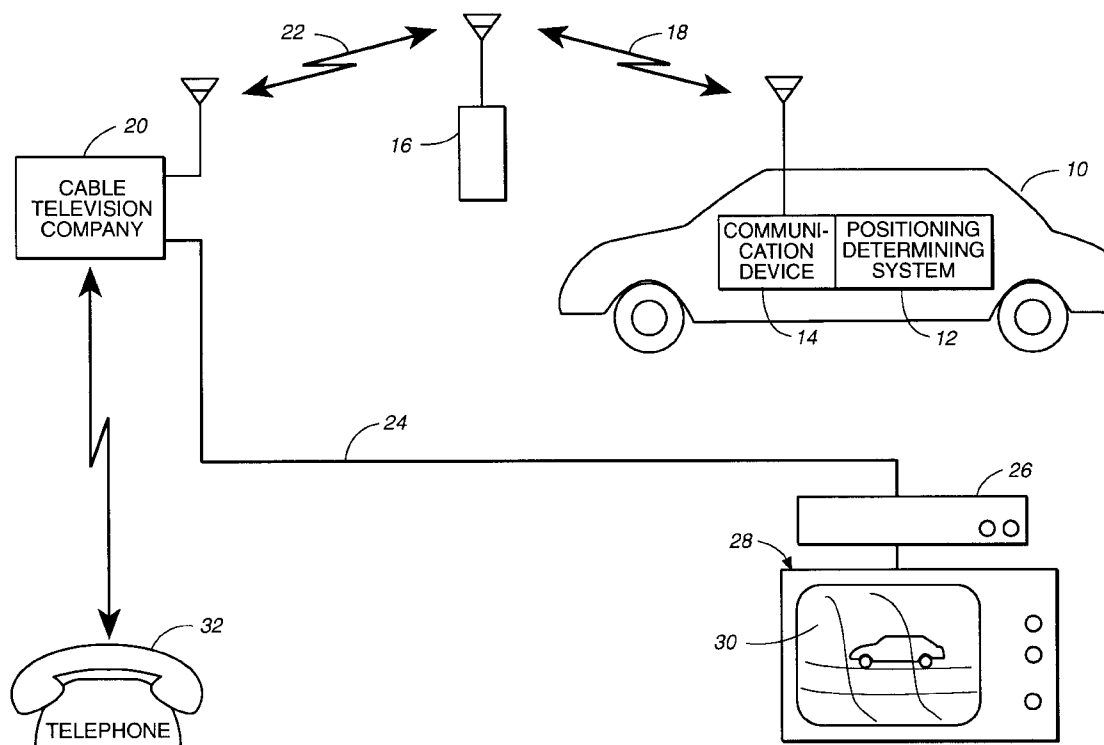
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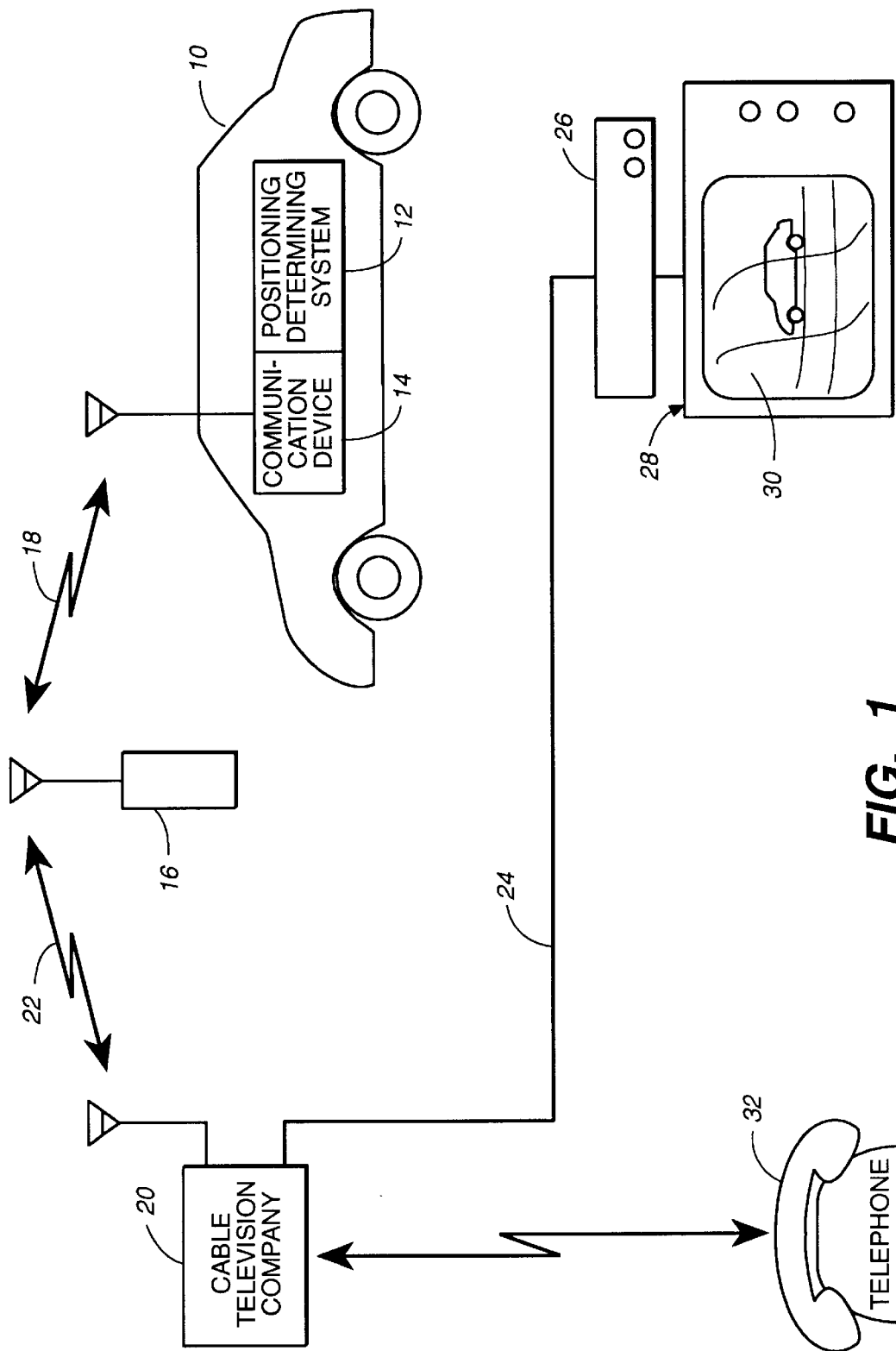
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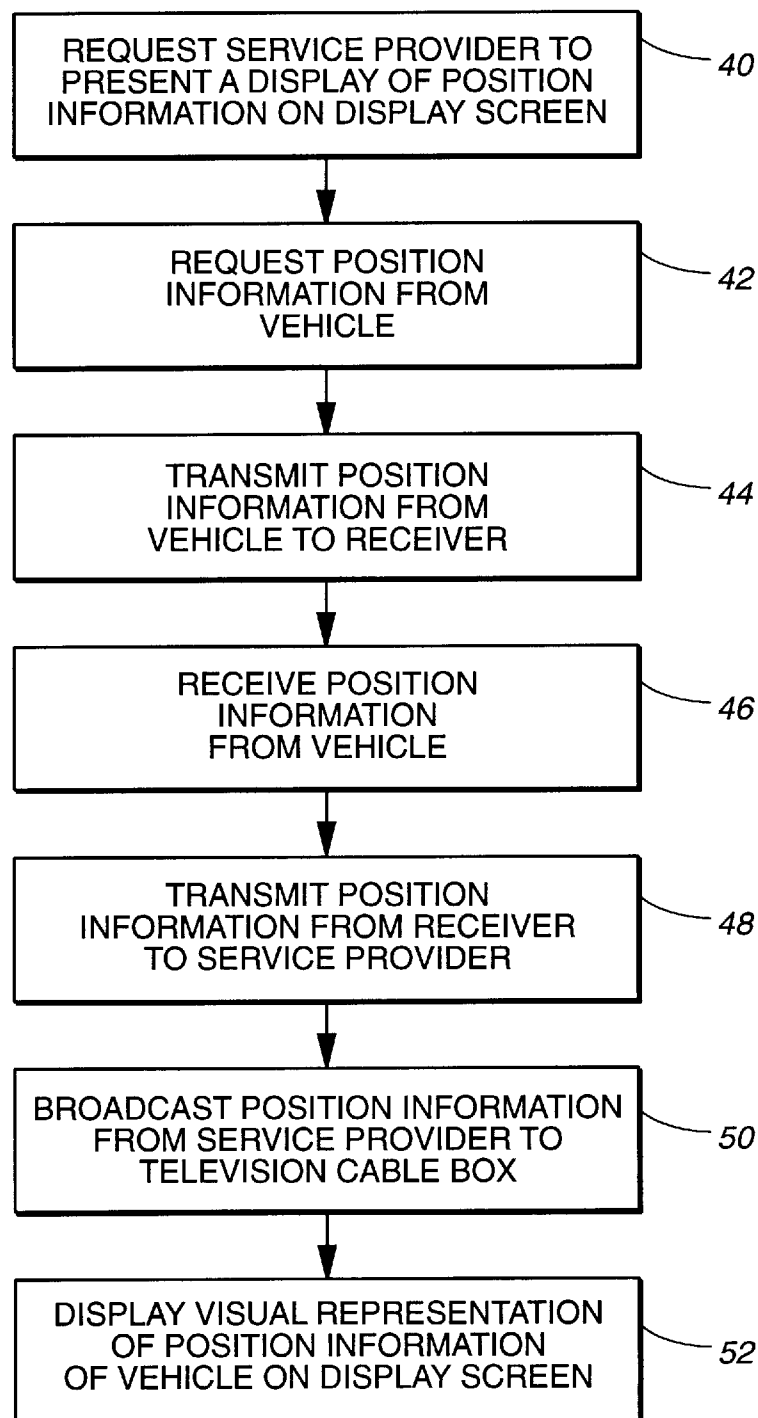
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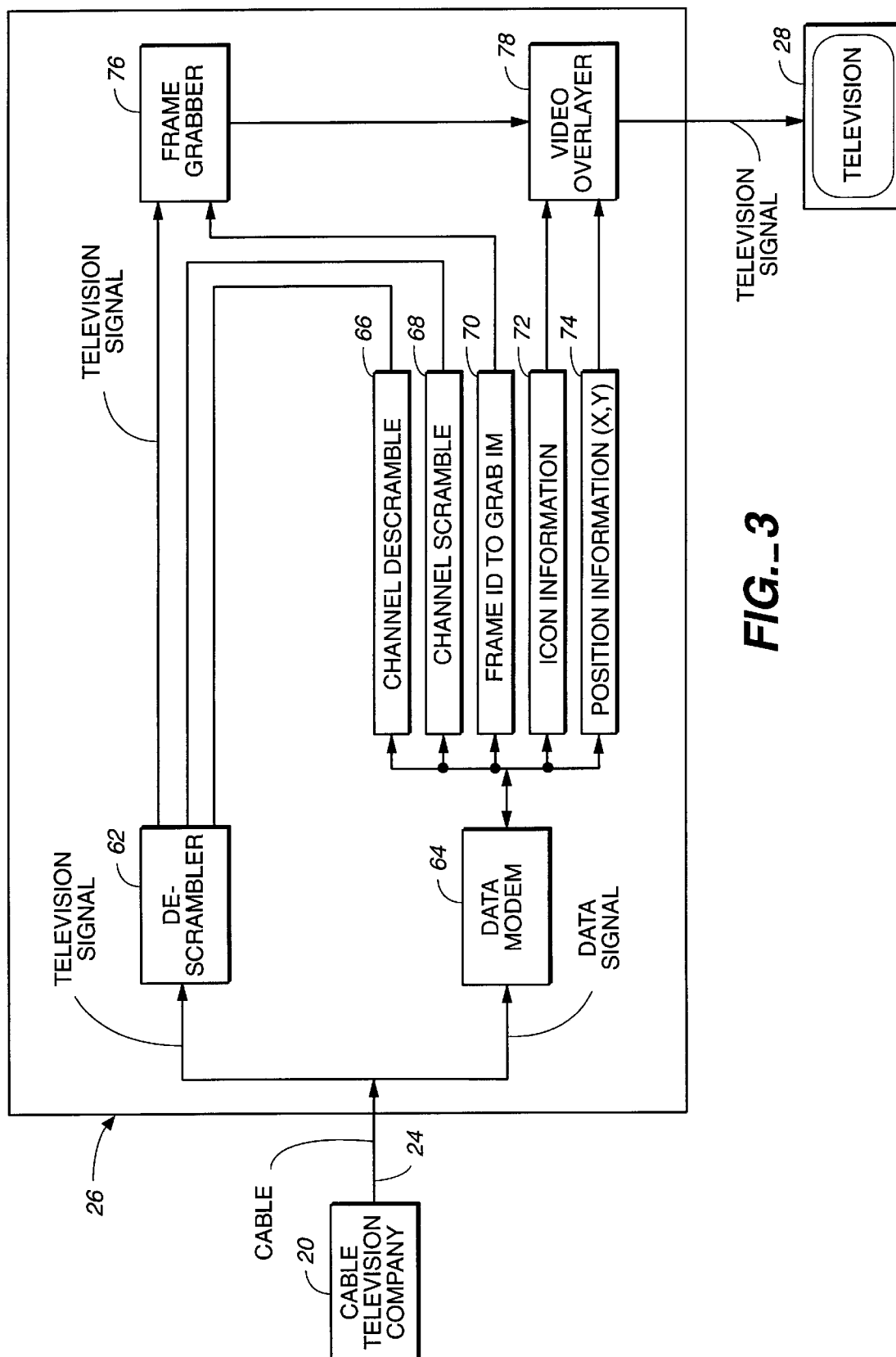
Primary Examiner—Michael Zanelli*Attorney, Agent, or Firm*—Wagner, Murabito & Hao[57] **ABSTRACT**

A system for visually representing the location of an item on a television. In one embodiment, a user of the present system telephonically requests that a visual representation of the location of an item be transmitted from a cable television company and displayed on the user's television. In the present embodiment, the user's television is connected with the cable television company by cable. Once the request is received at the cable television company, position information indicative of the location of the item is transmitted from the item to a receiver. The position information is then transmitted from the receiver to the cable television company. The acquired position information is then transmitted from the cable television company to the user's television. A visual representation of the position of the item is then displayed on the user's television.

23 Claims, 3 Drawing Sheets



**FIG. 2**



1

SYSTEM FOR AUTOMATIC VEHICLE LOCATION VIA CABLE TV

TECHNICAL FIELD

This invention relates to reporting the position of an item. Specifically, the present invention relates to displaying a visual representation of the location of the item on a television.

BACKGROUND ART

Prior art position reporting or tracking systems typically require a user to purchase numerous components. Such components include, for example, processors for deciphering position information of the tracked object, control panels for manipulating the system, display units for displaying the received position information, and the like. In addition to acquiring the numerous components, prior art systems also require that the user learns to operate the complex systems. Often, mastering the use of complex prior art systems is a difficult and time-consuming task for the average consumer.

Much of the difficulty associated with mastering prior art position reporting or tracking systems stems from the complexity of the systems, and the user's lack of familiarity with the required components. That is, many of the components, along with the operating parameters of the components, are new to the average consumer.

Furthermore, many of the prior art position reporting or tracking systems require the user to purchase or "download" a separate GIS database for use in conjunction with the system. The GIS database contains, for example, map information used when generating a display showing the location of the object being tracked. In addition to being expensive, a GIS database requires extensive memory. A GIS database is often limited to a specific geographic area. Therefore, many prior art reporting or tracking systems require the user to download or purchase several GIS databases to ensure coverage throughout a desired geographic area. Also, in order to remain accurate, each GIS database must be periodically updated or changed to keep the GIS database information current.

Thus, a need exists for a reporting or tracking system which reduces the number of costly components required to be purchased, a system which does not require the user to master complex and unfamiliar components, and a system which does not require a user to purchase and update at least one GIS database.

DISCLOSURE OF THE INVENTION

It is therefore an object of the present invention to provide a reporting or tracking system which reduces the number of costly components required to be purchased, a system which does not require the user to master complex and unfamiliar components, and a system which does not require a user to purchase and update at least one GIS database. The above object has been achieved by a system which visually represents the location of a selected item on a television.

In one embodiment of the invention, a user of the present system telephones a cable television company to request that a visual representation of the location of a selected item be transmitted from the cable television company to the user's television. The visual representation of the location of the selected item is subsequently displayed on the user's television. In the present embodiment, the cable television company is communicatively coupled to the selected item. Cable television companies include, but are not limited to,

2

TCI cable, COX cable, Pay-Per-View, and the like. The selected item, in turn, has a position determining system coupled thereto. Position information indicative of the location of the item is generated by the position determining system. When desired, the position information is transmitted from the item to a receiver. The position information is then transmitted from the receiver to the cable television company. In response to the user's request, the acquired position information is then transmitted from the cable television company to the user's television. A visual representation of the position of the item is then displayed on the user's television. Furthermore, in one embodiment, the position information displayed on the user's television is comprised of two parts. The first part of the displayed map information consists of a displayed map of the general area in which the item is currently located. The second portion of the position information consists of an icon representing the item. Video overlay techniques are used to overlay the icon on top of the appropriate portion of the underlying displayed map. In so doing, the present invention displays on the user's television, a map and an overlying icon representing the item's location on the map.

Thus, a user of the present invention employs devices which are readily available and which are familiar to the user. That is, the present invention only requires a user to operate a telephone and a television. As most consumer's own and are familiar with both a telephone and a television, the present invention eliminates much of the confusion and complexity associated with prior art reporting or tracking systems. Likewise, the present invention does not require the user to purchase or master the use of expensive and complex components associated with prior art reporting or tracking systems. As an additional advantage, in the present invention GIS databases are communicatively coupled to the cable television company. As a result, the present invention does not require a user to purchase or update any GIS databases.

These and other objects and advantages of the present invention will no doubt become obvious to those of ordinary skill in the art after having read the following detailed description of the preferred embodiments which are illustrated in the various drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention:

FIG. 1 is a schematic diagram of one embodiment of a position tracking and reporting system in accordance with the present claimed invention.

FIG. 2 is a block diagram showing steps used during operation of the present claimed invention.

FIG. 3 is a block diagram illustrating features within a cable box in accordance with the present claimed invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included

within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the present invention.

With reference now to FIG. 1, a schematic diagram of one embodiment of the present invention is shown. The following description of the present invention will begin with a detailed description of the physical characteristics of the present invention. This description will then be followed by a detailed description setting forth the operation of the present invention. Regarding the physical characteristics of the present embodiment, a vehicle 10 has position determining system 12 attached thereto. With reference to the embodiment of FIG. 1, position determining system 12 is shown attached to a personal vehicle. However, the present invention is also well suited to being attached to a commercial vehicle, to human beings, to pets, or to any desired object. A communication device 14 is coupled to position determining system 12. Position determining system 12 generates position information indicating, for example, the latitude, longitude, altitude, and velocity of tracking unit 10. Position determining system 14 also accurately determines the time at which vehicle 10 is at a specific location. In the present invention, position determining system 14 is, for example, a satellite-based radio navigation system such as the Global Positioning System (GPS), or the Global Orbiting Navigational System (GLONASS). Although such systems are specifically mentioned in the present embodiment, the present invention is also well suited to land-based radio navigation systems such as, for example, LORAN, Shoran, and Decca. Additionally, the present invention is also well suited to recording GPS ephemeris data. Likewise the present invention is also well suited to recording position information which has undergone differential corrections to provide more accurate position information.

Position determining system 12 is also able to generate velocity information when vehicle 10 is moving. Velocity information is obtained by measuring the Doppler shift of signals between an antenna of position determining system 10 and at least one radio navigation signal transmitter such as, for example, one of the GPS satellites, not shown. Additionally, position determining system 12 very accurately determines the time at which vehicle 10 is at any specific location.

As shown in FIG. 1, communication device 14 is communicatively coupled to a receiver 16 via communication link 18. Likewise, receiver 16 is coupled to a "service provider" 20 via communication link 22. Thus, in the present embodiment, receiver 16 is, for example, an intermediate transceiver for shortening the communication path between vehicle 10 and service provider 20. Although a receiver 16 is employed in the present embodiment, the present invention is also well suited to using multiple intermediate receivers. Additionally, the present invention is also well suited to having communication device 14 communicate directly with service provider 20. In the present embodiment, service provider 20 is a cable television company. Although such a service provider is utilized in the present embodiment, the present invention is also well suited to various other types of service providers.

In the present invention, communication links 18 and 22 are established through any of various techniques. For example, communication links 18 and 22 can be established using a Metricomm Wide Area Network (WAN) link operating at approximately 900 MHz. Communication links 18 and 22 can be established using a standard cellular telephone connection. Communication links 18 and 22 can also be established using a trunked radio system. In such a system for example, vehicle 10 first contacts "headquarters" or a communication base and is assigned a communication channel. Communication between vehicle 10, receiver 16, and cable television company 20 must take place over the assigned channel. Communication links 18 and 22 can also be established using a Cellular Digital Packet Data (CDPD) protocol. In the CDPD protocol, a modem and a radio are used to send data at a rate of 19.2 Kbits/s over cellular circuits not currently being used for voice transmissions. A control channel is called, for example, by vehicle 10, and vehicle 10 is assigned a channel. Vehicle 10 then bursts packet data, using, for example, TCP/IP protocol, to deliver the data to receiver 16 until the data is completely transmitted or until the channel is no longer free. If the data is not completely transferred when the channel expires, communication links 18 and 22 are then established using a different channel. As yet another example, communication links 18 and 22 can be established using a Subscription Mobile Radio (SMR) system wherein an assigned frequency is used for communication links 18 and 22. The present invention is also well suited to having rf-based communication links 18 and 22.

With reference still to FIG. 1, in the present embodiment, cable television company 20 is coupled via cable link 24 and cable box 26 to a television 28. Television 28 includes a display screen 30. The present invention also employs a telephone for telephonically contacting cable television company 20.

IN OPERATION

The following is a detailed description of the operation of the present invention. Once a user wishes to know the location of an item equipped with a position determining system, the user telephones the service provider using telephone 32. As shown in step 40 of FIG. 2, upon contacting the service provider, cable television company 20, the user requests that position information of vehicle 10 be displayed on display screen 30 of FIG. 1. With reference next to step 42 of FIG. 2, once the telephonic request for position information is received at cable television company 20, vehicle 10 is prompted to transmit the vehicle's position information to the service provider. As shown in step 44, in the present embodiment, the position information is first transmitted from vehicle 10 to receiver 16 via communication link 18 both of FIG. 1. In step 46, the position information is received at receiver 16. Step 48 shows that the position information is then transmitted from receiver 16 to cable television company 20 via communication link 22 of FIG. 1. Although such a "query" and "response" protocol is used in the present embodiment, the present invention is also well suited to numerous other protocols for acquiring the position information of the vehicle or any desired object at a service provider. With reference now to step 50 of FIG. 2, once the position information of the vehicle is acquired by cable television company 20, a visual representation of the position information is "broadcast" from cable television company 20 to television 28 of FIG. 1. In the present invention the broadcast of the position information is accomplished using well known cable television transmis-

sion techniques. That is, transmission of information is handled using a transmitter/modulator located in the head end or operations center of cable television company 20. The operations center takes the position information received from position determining system 12 and converts the information to a form compatible for transmission. Specifically, the operations center converts the information to a form compatible for transmission via, for example, coaxial cable, fiber optic, or a hybrid transmission system.

As shown in FIG. 1, in the present embodiment, the visual representation of the position information is sent to television 28 via cable link 24 and cable box 26. By using a standard cable television delivery format, several substantial advantages are realized. In a conventional cable television delivery system each cable box is uniquely addressable. That is, encoded television programming that is sent or broadcast to the entire receiving system can be decoded or unscrambled by a selected customer, groups of customers, or to the entire receiving system. As an example, a single customer can have a pay-per-view event decoded or unscrambled broadcast at that customer's television. Hence, each user of the present invention is uniquely identifiable by the service provider. Thus, each user can have selected position information relating only to that user's vehicle displayed on that user's television. As a result, the present invention allows multiple users to have different position information from respective multiple vehicles displayed on their respective televisions.

With reference now to FIG. 3, a schematic diagram is shown illustrating features contained within a cable television box 26 employed in the present invention. In the present embodiment, cable television box 26 is, for example, the JERROLD Impulse 7000 series cable television box. It will, however, be understood by those of ordinary skill in the art that cable television box 26 could be any of numerous other cable television boxes well known in the art, including readily available beta-test models having a frame grabber integral therewith.

As shown in FIG. 3, cable television box 26 receives cable television signals via cable link 24. The signals include both data and television signals. The television signals are directed into a descrambler 62, while the data signals are directed into data modem 64. Using channel descramble logic 66, data modem 64 tells descrambler 62 which of the incoming encoded television signals are to be decoded or unscrambled. Likewise, using channel scramble logic 68, data modem 64 tells descrambler 62 which of the incoming encoded television signals are to remain encoded or scrambled. As shown in FIG. 3, in the present embodiment, data modem 64 also employs frame ID information logic to instruct frame grabber 76 which frames are to be grabbed. Although frame grabber 76 is shown integral with cable television box 26 in the present embodiment, the present invention is also well suited to having frame grabber 76 disposed other than integral with cable television box 26. Additionally, the diagram of FIG. 3 is intended to be an example of the types of features contained within a cable television box. It will, however, be understood by those of ordinary skill in the art that cable television box 26 can contain numerous other components and features which have not been shown for purposes of clarity.

Referring still to FIG. 3, using icon information logic 72, data modem 64 tells video overlayer 78 what type or shape of icon to place onto display 30 of television 28. Data modem 64 uses position information (x, y) logic 74 to tell video overlayer 78 where to place the icon on display 30 of television 28. The present detailed description contains

additional details on the operation of the present invention including cable television box 26.

With reference again to FIG. 2, as shown in step 52, the visual representation of the position information is displayed on display screen 30 of television 28. The visual representation of the position information is "grabbed" by the user using well known frame grabbing techniques employed by frame grabber 76 of FIG. 3. Such frame grabbing techniques allow the user to selectively grab desired information transmitted from the cable television company. In so doing, the user only displays position information of interest to that particular user. That is, frequently the cable television company will be transmitting position information directed towards numerous users. However, frame grabbing techniques allow each user to selectively grab only the information desired by that user.

With reference again to FIG. 1, in the present embodiment, the visual representation of the position information for the user's vehicle is displayed in a "map" format. That is, a map is transmitted to the user's television of the area in which the user's vehicle is currently located. Although such a visual representation is used in the present embodiment, the present invention is also well suited to numerous other visual representation formats. Other visual representation formats include, but are not limited to, a numeric display of the vehicle's latitude, longitude, and altitude, a display of the vehicle's location with respect to a selected way point, a display of the vehicle's speed and heading, the street address at which the vehicle is located, and the like. As an additional advantage, the present invention eliminates the need for each user to purchase a GIS database. In the present embodiment, GIS databases are kept by the service provider. Therefore, users of the present invention have access to GIS databases without being required to purchase or download GIS information.

In the present embodiment, the position information displayed on the screen includes an icon or image representing the location of the vehicle with respect to the map information already displayed on the display screen. The icon or image is generated over the displayed map is accomplished using well known video overlay techniques employed by video overlayer 78 of FIG. 3. Such video overlay generation is achieved by video overlayer 78 using, for example, readily available integrated circuits such as the Motorola MC144144. Such circuits contain a phase lock loop that will frequency and phase lock to the timing contained within the television.

Hence, in the present invention, the position information displayed on the user's television is comprised of two parts. In the present embodiment, the first part of the displayed map information consists of a displayed map of the general area in which the vehicle is currently located. The second portion of the position information consists of an icon representing the vehicle. Video overlay techniques are used to overlay the icon on top of the appropriate portion of the underlying displayed map. In so doing, the present invention displays on the user's television, a map and an overlying icon representing the vehicle's location on the map.

The present invention is also well suited to repeatedly or continually displaying a visual representation of the position information for the user's vehicle. In such an embodiment, a "movie-like" visual representation of the position information of the vehicle is displayed on the user's television. Thus, the present invention is well suited, for example, to allowing a user to "monitor" the path or progress of a vehicle. The present invention has numerous applications

such as, for example, allowing a concerned parent to follow the path of a vehicle containing a child, monitoring delivery vehicles, tracking and locating a pet, and the like. Furthermore, because the present invention is displayed on a standard television, the visual representation can easily be recorded using standard VCR equipment. Hence, a record of the path traveled, for example, by a delivery vehicle can be recorded and stored for subsequent review.

The present invention is also well suited to generating icons relevant to the end user. That is, the present invention is also well suited to generating an icon of the end user's choice using icon information logic 72 of FIG. 3. Thus, if the user wishes to know the location of an semi-tractor trailer, the icon generated on the display screen can be selected to depict such a vehicle. Such icon selection can be programmed at the user's cable television converter box 26 using, for example, icon information logic 72 or at the cable television company. That is, in the present invention, cable box 26 is programmed to display an icon of a desired design. However, cable television company 20 is well suited to having cable television company 20 transmit information to cable box 26 thereby directing cable box 26 to display a desired icon. In either event, well known and readily available technology for generating video overlay is used to accomplish the task.

As yet another advantage, because the present invention utilizes a conventional cable television broadcasting station, a billing system is already in place. That is, each user can simply be billed on a monthly cable television bill. The amount billed to the user is based, for example, on frequency and duration of use. Also, the present invention only requires a user to operate a telephone and a television. As most consumer's own and are familiar with both a telephone and a television, the present invention eliminates much of the confusion and complexity associated with prior art reporting or tracking systems.

Thus, the present invention provides a reporting or tracking system which reduces the number of costly components required to be purchased, a system which does not require the user to master complex and unfamiliar components, and a system which does not require a user to purchase and update at least one GIS database.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

I claim:

1. A system for visually providing position information representing the location of an item, said system comprising:

a cable television service provider coupled to a receiver which, in turn, is communicatively coupled to a position determining system monitoring an item to be located, said receiver adapted to receive position information of said item, said cable television service provider further adapted to transmit said position information received at said receiver to a display device.

2. The system for visually providing position information as recited in claim 1 wherein said cable television service

provider is coupled to a data input device, said data input device adapted to request transmission of said position information of said item from said cable television service provider to said display device.

3. The system for visually providing position information as recited in claim 1 wherein said position determining system is selected from the class of satellite-based radio navigation systems consisting of the Global Positioning System and the Global Orbiting Navigation System.

4. The system for visually providing position information as recited in claim 1 wherein said position determining system is selected from the class of ground-based radio navigation systems consisting of LORAN, Shoran, Decca, and TACAN.

5. The system for visually providing position information as recited in claim 1 wherein said cable television service provider is coupled to a data input device, said data input device adapted to request transmission of said position information of said item from said cable television service provider to a television.

6. The system for visually providing position information as recited in claim 1 wherein said cable television service provider is coupled to a telephone, said telephone for requesting transmission of said position information of said item from said cable television service provider to said display device.

7. A system for visually representing the location of an item, said system comprising:

a position determining system coupled to an item to be located,

a receiver communicatively coupled to said position determining system, said receiver adapted to receive position information of said item,

a display device adapted to display a visual representation of said position information of said item,

a cable television service provider communicatively coupled to said receiver, said cable television service provider transmitting said position information received at said receiver to said display device, and

a data input device communicatively coupled to said cable television service provider, said data input device adapted to request transmission of said position information of said item from said cable television service provider to said display device.

8. The system of claim 7 wherein said position determining system is selected from the class of satellite-based radio navigation systems consisting of the Global Positioning System and the Global Orbiting Navigation System.

9. The system of claim 7 wherein said position determining system is selected from the class of ground-based radio navigation systems consisting of LORAN, Shoran, Decca, and TACAN.

10. The system of claim 7 wherein said item to be located is a vehicle.

11. The system of claim 7 wherein said display device is a television.

12. The system of claim 7 wherein said data input device is a telephone.

13. A method for visually representing the location of an item on a display device comprising the steps of:

requesting, from a cable television service provider, a visual representation of the location of an item,

acquiring, at said cable television service provider, position information indicative of the location of said item, transmitting said acquired position information from said cable television service provider to a display device,

displaying a visual representation of said position information of said item on said display device.

14. The method as recited in claim 13 wherein said step of requesting, from said cable television service provider, a visual representation of the location of an item further comprises requesting, from said cable television service provider, a visual representation of the location of a vehicle. 5

15. The method as recited in claim 14 wherein said step of using a data input device to perform said request further includes using a telephone to perform said request. 10

16. The method as recited in claim 13 wherein said step of requesting, from said cable television service provider, a visual representation of the location of an item further includes using a data input device to perform said request. 15

17. The method as recited in claim 13 wherein said step of acquiring, at said cable television service provider, position information indicative of the location of said item, further includes the step of using a position determining system selected from the class of satellite-based radio navigation systems consisting of the Global Positioning System and the Global Orbiting Navigation System to generate said position information indicative of said location of said item. 20

18. The method as recited in claim 13 wherein said step of acquiring, at said cable television service provider, position information indicative of the location of said item, further includes the step of using a position determining system selected from the class of ground-based radio navigation systems consisting of LORAN, Shoran, Decca, and TACAN to generate said position information indicative of said location of said item. 25

19. The method as recited in claim 13 wherein said step of transmitting said acquired position information from said cable television service provider to said display device further comprises transmitting said acquired position information from said cable television service provider to a television. 30

20. A method for visually representing the location of an item on a television comprising the steps of:

requesting that a visual representation of the location of an item be transmitted from a cable television company and displayed on a television,

generating position information indicative of the location of said item,

receiving said position information at a receiver communicatively coupled to said item,

transmitting said position information from said receiver to said cable television company communicatively coupled to said receiver,

transmitting said acquired position information from said cable television company to said television,

displaying a visual representation of said position information of said item on said television.

21. The method as recited in claim 20 wherein said step of requesting that a visual representation of the location of an item be transmitted from a cable television company and displayed on a television further comprises the step of telephonically requesting that a visual representation of the location of a vehicle be transmitted from said cable television company and displayed on said television.

22. The method as recited in claim 20 wherein said step of generating position information indicative of the location of said item further comprises the step of generating said position information using a position determining system selected from the class of satellite-based radio navigation systems consisting of the Global Positioning System and the Global Orbiting Navigation System. 30

23. The method as recited in claim 20 wherein said step of generating position information indicative of the location of said item further comprises the step of generating said position information using a position determining system selected from the class of ground-based radio navigation systems consisting of LORAN, Decca, and TACAN.

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